2141-6002-RU001

APOLLO SPACECRAFT SYSTEMS ANALYSIS PROGRAM
TAS NO. ASPO-15 (SUBTASK 1)

CONTROL PLAN FOR MASS PROPERTIES (REVISION A)

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS
NAS 9-4810

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Approved A Kasumoff
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Apollo Spacecraft Systems
Analysis Program

ORGANIZATION OF
APOLLO SPACECRAFT

OVERALL CRITICAL PARAMETER
CONTROL PLAN

Section

CONTENTS

TABLES

2. CONTROL PLAN FOR MASS PROPERTIES

2.1 INTRODUCTION

This document establishes a system for support of NASA/MSC in the management of mass properties during procurement and the utilization of the Apollo Spacecraft. It is designed to permit the acquisition of systematized, verifiable and controllable mass properties of the spacecraft systems, to facilitate rapid establishment and reporting of inputs for the weight/performance relationship, to exercise mass properties control, and to develop trend analyses from the reported systems.

Mass Properties are defined as system parameters of weight, three-axis centers of gravity, moments of inertia, products of inertia (or principal axis angles) and mass distribution whose values are required to perform trajectory analysis, establish performance capability, perform loads and dynamic analyses, and establish stability and control qualities.

Critical Mass Parameters are those particular mass properties values on overall system characteristics which are decisively constrained or exceeded by limiting conditions of the overall system design and operating characteristics.

Critical Performance Weights are those critical mass parameters corresponding to system conditions whose weights are decisive in their influence on overall system capability for the desired flight trajectory.

2.2 PROGRAM OBJECTIVE

The program objective is to guarantee, through evaluation of proposed designs, a minimum weight spacecraft that still retains reliability, structural integrity, and maximum equipment capacity by:

- Determination of trend relationships between current mass properties and specifications (base data).
- Control of valid mass properties parameters that are constrained by the limiting design conditions of the system, or which have critical influence on the system performance capability.

2.3 NASA REQUIREMENTS UPON PERFORMING CONTRACTORS (NAA AND GAEC)

2.3.1 Organization (Part of Reference A – Paragraph 2.1)

Each contractor shall submit to the procuring activity an organization chart and descriptive material identifying the mass properties control personnel, their responsibilities, and their relationship to other elements of the contractors organization. This chart shall also include the names of key personnel and the percentage of their time devoted to the subject NASA contract. This information will be for NASA internal use only.

2.3.2 Control

2.3.2.1 Planning

To assure effective planning, optimization, and control of mass properties, each contractor shall develop and maintain a mass properties control system. The contractor shall employ capable personnel that have both the responsibility and the authority to effectively study, analyze, document, report, and control mass properties in general accordance with Reference A as defined and implemented by NASA/MSC per References B, C and D. The responsibilities of the contractor's mass properties control personnel shall include but not be limited to the following:

- Mass properties analyses shall be performed for all alternate design configurations included in optimization studies. The results of these analyses shall be documented and reported to the procuring activity.

- Assistance shall be provided by the contractor's mass properties control personnel in the establishment of specification weights. The specification weights shall become an item on the applicable contract.

- The contractor shall be responsible for the adequacy of mass properties data developed by subcontractors and vendors where applicable, a mass properties section shall be prepared and incorporated into each procurement specification issued by contractor for use by subcontractors or vendors. This section shall establish weight, centers of gravity and inertia requirements for the item(s) being procured. The mass properties control personnel shall establish mass properties control and reporting requirements for subcontractors and vendors comparable to and compatible with the requirements of this document. Mass properties data from subcontractors and vendors shall be made available to the ASPO when requested.

- Measuring programs for the determination of the actual weight of components shall be established. The measured data shall replace the calculated data in mass properties reports as the fabrication cycle progresses. Increases in the percentage of actual measured data reported will indicate progress and serve as a check for the calculated data.

- The actual mass properties of the spacecraft shall be measured to substantiate estimated and calculated mass properties data and propellant loading requirements. The contractor shall develop procedures, methods, and necessary equipment to perform the actual physical measurements of mass properties for each location at which measurements will be made. A written explanation and verification of measuring methods and procedures for each installation of measuring equipment shall be submitted to the ASPO for approval at least ninety (90) days prior to the first major measurement to be performed at that location. Each written explanation shall include the following:

  1) Measurements to be performed

  2) Measurement objectives, including accuracy and precision requirements

  3) Description of equipment, instrumentation, and physical setup

  4) Diagrams of measuring equipment and related fixtures showing pertinent dimensions and reference datums

  5) Measurement procedures

  6) Equipment calibration procedure, including schedule, responsible group, and location of the calibration facilities. (Initial schedule to require calibration prior to each use. Subsequent increase of period between calibrations to be based on statistical data.)

  7) Analysis of overall accuracy to be achieved

  8) An analysis of the instrumentation and data reduction methods to verify the anticipated accuracy

  9) Schedule, including equipment availability data and anticipated test start and completion dates

  10) All alignment tolerances for fixtures. Such tolerances when set shall not be increased by operation personnel.

The contractor shall notify the procuring activity of the time and place of all major measurements at least seven (7) days in advance in order that an ASPO representative may be present. At the time of any major measurement, the

spacecraft or component shall be in the dry condition (less all usable or residual liquids and gases) insofar as it is practical, and shall be at least 95 percent complete by weight excluding hazardous ordnance items and design components not normally installed at the time or location at which the measurement is to be made.

The field support plan shall assure that records of the weight, centers of gravity, and inertial characteristics of the vehicle are maintained in a current status and reported in a timely manner. It shall provide for continuous Critical Mass Properties Performance inputs for trajectory simulations and targeting parameters during the preflight phases and flight phases and be so conceived that it may be executed by either the procuring activity or its designee. This plan shall be submitted to the ASPO within sixty (60) days following implementation of the ASPO requirements document and shall include:

1) A detailed description of the procedures to be employed so that the effect of changes and modifications on mass properties parameters are currently and rapidly reflected in the data records.

2) The methods and channels to assure rapid current data reporting to the responsible agency, and where required, to other contractors in periods prior to and immediately after flight.

3) A description, and intended use of applicable equipment and facilities.

4) A schedule of events from factory weighing to system launch for the various weight operations, inspecti tests and reports.

5) A stipulation of any go/no-go based on mass properties requirements which are to be included in the countdown events.

2.3.2.2 Monitoring

The mass properties data shall be continually analyzed and monitored to determine trend relationships between current mass properties and specification requirements. The contractor's mass properties control personnel, working with analytical and design personnel and considering governing criteria such as reliability, weight, schedule, and cost, shall explore means to insure that specification mass properties requirements are met or bettered.

2.3.2.3 Reports

The following reports shall be included as required design, development and production documentation:

	Title	*Reference-Requirement Paragraph Number Reference A	Reference B	Reference D
1.	Monthly Mass Properties Status Report	2.7.4.2	4b	2.4.2
2.	Actual Measurement Report	2.7.7	4c	2.4.3
3.	Predicted Preflight Report	2.7.5	4d	2.4.4
4.	Final Preflight Report	-	4e	2.4.5
5.	Pre-Launch Data	-	4f	2.4.6
6.	Critical Design Study Data	2.6.10	4j	-
7.	Computer Cards or Tape	2.6.12		-
8.	Actual Weight Summary	-	5m n	2 5.3
9.	Mass Distribution and Advanced Powered Flight Mass Properties	-	5r	2.5.16
10.	Control Log Data	2.6 11	4c	-
11.	Weight and Balance History Log Summary	-	5p	2.5.15

*Refer to Table 2-1 for references.

Table 2-1. References

A.	M-DE8000.006, "Apollo Program Directive - Mass Properties Standard," 1 June 1963.
B.	ASPO-PE5-13-10, NASA/MSC, "Apollo Spacecraft Program Office Mass Properties Requirements for the Lunar Excursion Module," Undated.
C.	ASPO-PE5-13-11, NASA/MSC, "Crew Systems Division Mass Properties Requirements," Undated.
D.	ASPO-PS5-13-12, NASA/MSC, "Apollo Spacecraft Program Office Mass Properties Requirements for the Command Module, Service Module, Launch Escape System and Adapter," Undated.
E.	"Prediction Analysis and Management Decisions;" NASA Manned Space Flight Office, Undated.

2.4 PROGRAM OPERATION – (TRW)

The spacecraft conceptual design control data will be reviewed, analyzed, documented and continuous mass properties analyses will be performed. Subsystem weight analyses will be performed to ensure the proper weight considerations during the design stage of the Apollo Spacecraft. Detailed evaluation of the proposed design will guarantee a minimum weight S/C that still retains reliability, structural integrity and maximum equipment capacity. All subsystem component mass property inputs will be checked to ensure the reasonability and validity of the values.

TRW will prepare and issue a Control Mass Properties Requirements Document in the earliest stage of task performance. The data contained therein will include the technical basis for derivation of component assembly values and serve as a basis for data comparison and for data to be included in any Mass Properties Specifications.

TRW will continually analyze and monitor the mass properties data to determine trend relationships between current mass properties and specifications (base lined mass properties control section,

The proposed means of ensuring that specification mass properties requirements are met or bettered is for the mass properties control section to work with analytical personnel, S/S Managers, ASSAP and ASPO (NASA/MSC, TRW and Contractors) to determine optimum mass properties while considering governing criteria such as reliability, weight, schedule and cost.

To assure NASA/MSC and TRW Program Management that program objectives will be met, and the contract requirements have been fulfilled, monitoring will be accomplished, trends will be established and control will be effected as a result of Monthly Tab Runs and Detailed Mass Properties Reports.

The TRW Mass Properties Section will conduct studies, analyze and prepare data as required to determine that the current critical mass properties and their associated uncertainties are valid, compatible with the mission configuration and conditions, and are within allowable tolerances. The noted mass property Critical Parameter Responsible Engineer will receive technical direction from, and will directly support, the TRW Apollo Spacecraft System Analysis Program Office (or appointee). These activities shall include but not be limited to, the following:

- Establish, administer and monitor the TRW mass properties control program to assure fulfillment of program objectives and coordinate data for and when required, conduct subprogram meetings.

- Coordinate, review, analyze, and document spacecraft mass properties control data as required. The values will be used as a point of departure or baseline in all required reports and will include the technical basis for derivation of control numbers.

- Coordinate, review, analyze, and document GFE control data. The values will be used as a point of departure or baseline in all required reports and will include the technical basis for derivation of all numbers.

- Coordinate contractors' monthly mass properties status reports and prepare an integrated spacecraft Mass Properties Status Report for use by TRW critical parameter responsible engineers. The report shall be prepared in general accordance with Reference A - Paragraph 2.7.4.2.

- Coordinate contractors monthly detailed mass properties data (magnetic tapes to 4th and 5th generation) and prepare detailed weight and center of gravity values (tab run) for responsible NASA/MSC subsystem managers. The noted tab runs must be hand-carried to, and coordinated with, NASA/MSC (J. L. Bullard/O. O. Ohlsson) each month.

- Prepare monthly subsystem managers weight prediction analysis. The data will be received from TRW (CDRC) in graphical form and submitted to NASA/MSC (J. L. Bullard/O. O. Ohlsson) each month.

- Prepare monthly mass properties detail reports and prediction analyses as a basis for subsystem evaluation, (i.e., conduct analysis as required to determine that the current critical mass properties and their associated uncertainties are valid, compatible with the mission configuration and conditions, and are within allowable tolerances). The report will include a Title Page, Table of Contents, Introduction and Technical Summary, Prediction Analysis Graphs, Charts, (to compare and evaluate the current mass properties status with respect to allowable mass properties objective), and Problem Areas.

- Subsystem Evaluation - Evaluate and recommend corrective action if it is determined (reported problem areas) that a degradation in mass properties status in relation to the objectives exists, appears to be imminent or that the limiting mass properties design conditions have been encroached upon. The corrective action or recommendation shall be coordinated with other critical parameter responsible engineers, technical area responsible engineers (NASA/Contractors/TRW), ASSAP and ASPO Management. Evaluation of hardware or subsystem design changes will be under the cognizance of the subsystem engineer.

- Coordinate all subsystem evaluation data with reported prediction analysis, evaluate on a system level, and make recommendations to Critical Parameter Review Board.

- Prepare monthly mass properties inputs to the Critical Parameters Report. The inputs will be a status-type report including mass properties major problems, current and contingency data, interaction of critical parameters and a description of mass properties margins.

- Prepare, as required, mass properties inputs to Final Action report for submittal to ASPO by ASSAP Program Management. The inputs will be a status-type report including mass properties problem areas, impact on program, solutions, discussions, and final recommendations.

- Maintain constant coordination with NASA/MSC (J.L. Bullard and Subsystem Engineers), Contractors and TRW Program Management.

- Informal mass properties supplemental support (technical analysis as required in the areas of Shopping Lists, NASA/MSC Responsible Engineer, Pre-ECP's etc.).

2.4.1 Data Requirements - Source

2.4.1.1 Mass Properties Status Reports - Contractors

(Reference A - Paragraph 2.7.4.2)

2.4.1.2 Magnetic Tapes - Detail Mass Properties Data - Contractors

(Reference D - Paragraph 2.4.8)

2.4.1.3 GFE Control Data - NASA/MSC

(To be reviewed and updated by TRW)

2.4.1.4 Mass Properties Control Data - NASA/MSC

(To be reviewed and updated by TRW).

2.4.1.5 Shopping Lists - Contractors

(Contractor recommended mass properties changes for NASA/TRW analysis)

2.4.1.6 NASA Responsible Engineer Input

2.4.1.7 Pre-ECP's - TRW Specification Analysis System

2.4.2 Data Validation

Data validation will include the following:

- The spacecraft mass properties control values will be coordinated, reviewed, analyzed, and documented.

- The GFE mass properties control values will be coordinated, reviewed, analyzed, and documented.

- The mass properties control values included in the contractor status reports, used to compare and evaluate the current mass properties data, will be verified by cross reference (i.e., documented control values vs contractor reported control values).

- The detail mechanics of contractor reported data will be checked for resonability.

- Informal inputs will be validated in accordance with engineering judgment.

2.4.3 Data Processing

In the interest of speed, economy and accuracy the TRW Mass Properties Section is developing two electronic data processing programs. The noted programs are required to generate inputs to the Monthly Detail Mass Properties Report, the Critical Parameters Report and the Service Report to NASA.

One of the programs will generate a detail tabulation of the spacecraft components for which each NASA Subsystem Manager is responsible. The data listed for each component are functional code, current weight, percentage of estimated/calculated/actual weights and centers of gravity. Also the program gives to the subsystem managers, module and spacecraft totals. For these totals a maximum allowable weight, previous reported weight, and the differences of the current weight and these two weights will be tabulated.

The second program is for prediction analysis. Using one of four math models (linear, nonlinear, Fourier and logistic), the program will develop a weight trend for each functional total within a Subsystem Manager's responsibility. Then a subroutine will sum these trends to obtain trends on the subsystem manager, module, and spacecraft levels. The trends will be presented in tabular and graphical form.

The inputs for these programs will be obtained from contractor magnetic tapes.

Problem areas, not adaptable to machine programming or where the magnitude of the job does not require machine processing, will be analyzed and documented by the mass properties cognizant engineer or technical support personnel.

2.4.4 Mass Properties Status Evaluation

2.4.4.1 Margin Analysis

Mass Properties reports (TRW-prepared) will include current margin analyses based on current weight data vs maximum allowable weight data.

The effect of weight prediction analysis will be considered in the derivation of weight margins. Prediction analysis is defined as that process which assesses the past and present facts, near-time certainties, and the probabilistic events of the future. Therefore, prediction analysis will provide quantitative answers which attest to the existence of a stated condition (e.g., weight growth), define its magnitude, and describe the effects of alternate management actions which might be applied in attainment of stated objectives. The method of deriving predicated values is outlined in the Reference E.

2.4.4.2 Trends

2.4.4.2.1 Budgeting. All mass properties budgets will be included as part of the Control Mass Properties Requirements Document or Specification.

Control of mass properties will be as noted under Mass Properties Control Section 2.4 - Items 1 through 13.

2.4.5 Critical Parameter Subsystem Status Report

The TRW Mass Properties Section will prepare inputs to the Monthly Critical Parameters Report. The inputs will be a status-type report including mass properties major problems, current and contingency data. interaction of critical parameters and a description of mass properties margins.

2.4.5.1 Performance Data Book

A master properties data book Control Mass Properties Document) shall be developed and will contain information on requirements for supporting data for the critical parameter subsystem status report for DRM and specific missions.

2.4.6 Review Board Action

2.4.6.1 Deficiency Analysis

Deficiency Analysis will be included as part of the subtask noted in item 7 of Section 2.4. It is recommended that the Mass Properties Section have membership on the Review Board.

2.4.6.2 Subsystem/System Interface Control

The Subsystem/System Interface Control will be effected by coordination between mass properties personnel and problem area cognizant engineers (NASA, TRW and Contractors).

2.4.7 Corrective and Improvement Action

The mass properties corrective and improvement activities shall include but not be limited to the following.

Coordinate, review, analyze, and document a mass properties control statement. Allowable control weight objectives shall be allocated to each major area of design responsibility.

Periodic review with NASA Subsystem Managers shall be effected to compare and evaluate the current mass properties status with respect to allowable weight objectives.

Recommend corrective action if, by evaluation, it is determined that a degradation in mass properties status in relation to the objectives exists, appears to be imminent or that the limiting design conditions have been encroached upon. The recommended corrective action shall be coordinated with other critical parameter responsible engineers, technical area responsible engineers, ASSAP and ASPO Program Management. Evaluation of hardware or subsystem design change will be under the cognizance of the subsystem engineers.

2.5 ASSESSMENT OF EXISTING PROGRAM CAPABILITIES

2.5.1 Adequacy of Controls

The existing NASA/MSC mass properties program as defined by References A through D (Table 2.1) is adequate when totally implemented.

There is no realistic basis which enables TRW to evaluate the contractors mass properties control program.

The current mass properties status indicates a potential overweight condition in the overall Spacecraft.

2.5.2 Modifications Required

Preparation and implementation of a Control Mass Properties Requirements Document. The document should be similar to the

NASA/Headquarters Specification SE-007.000-1 "Apollo Program Control Weights Requirements," dated 16 September 1964 but should include weight and center of gravity control data in addition to weight data.

2.6 PROGRAM IMPLEMENTATION (Tables 2-2 and 2-3)

2.6.1 Initial Objectives

Initial objectives are to:

- To complete implementation of all noted subtasks.
- All major subtasks noted in Section 2.4 have been initiated.

2.6.2 Budget Requirements

Initial Implementation - Completed

2.6.2.1 Sustaining Effort

The manpower is listed by subtask paragraph number as follows:

Section 2.4 Item No.	Unit Manpower Man-Months/Month	Time Period	Total Manpower Man-Months
1	0.4	9-65 thru 7-66	4.4
2	0.4	9-65 thru 7-66	4.4
3	0.4	10-65 thru 7-66	4.0
4	0.7	10-65 thru 7-66	7.0
5	0.4	9-65 thru 7-66	4.4
6	0.4	10-65 thru 7-66	4.0
7	0.4	10-65 thru 7-66	4.0
8	0.7	10-65 thru 7-66	7.0
9	0.2	10-65 thru 7-66	2.0
10	0.1	10-65 thru 7-66	1.0
11	0.2	10-65 thru 7-66	2.0
12	0.4	9-65 thru 7-66	4.4
13	0.3	9-65 thru 7-66	3.3
TOTAL	5.0	TOTAL	51.9

Summary:

9/65 Requirements = 1.9 Man-Months/Month

10/65 - 7/66 Requirements = 5.0 Man-Months/Month

Table 2-2. Milestone Chart

Legend: Δ Subtask Completion
o Report Due Date

Section 2.4 Item No.	Work Description	9/65	10/65	11/65	12/65	1/66	2/66	3/66	4/66	5/66	6/66	7/66
1	Manage M. P. Program	—	—	—	—	—	—	—	—	—	—	Δ
2	Mass Properties Control Inputs	—	—	—	—	—	—	Δ				
3	M. P. – GFE Control Inputs	—	—	—	—	—	—	Δ				
4	Monthly M. P. Report-Perf. Analysis			o	o	o	o	o	o	o	o	Δ
5	Prepare Tab Run NASA/MSC S/S Mgr.		o	o	o	o	o	o	o	o	o	Δ
6	M. P. Prediction Analysis		o	o	o	o	o	o	o	o	o	Δ
7	M. P. Detail Reports S/S Eval.		o	o	o	o	o	o	o	o	o	Δ
8	M. P. Subsystem Evaluation	—	—	—	—	—	—	—	—	—	—	Δ
9	M. P. Monthly Data Sys. Trade-off Studies	—	—	—	—	—	—	—	—	—	—	Δ
10	M. P. Inputs to Critical Parameters Reports			o	o	o	o	o	o	o	o	Δ
11	M. P. Inputs to Final Action Report				o	o	o	o	o	o	o	Δ
12	M. P. Program Coordination	—	—	—	—	—	—	—	—	—	—	Δ
13	Misc Support	—	—	—	—	—	—	—	—	—	—	Δ

2.7 SUMMARY OF PROGRAM BENEFITS

NASA/MSC, as the System Engineering and Technical Direction Center for the Apollo Spacecraft Program, is responsible for overall Mass Property Control.

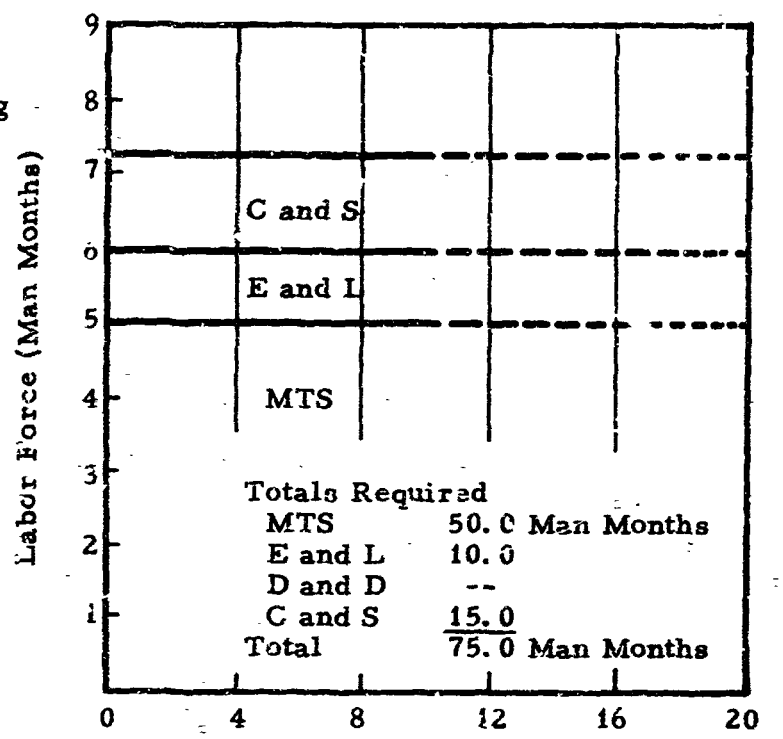
In order to provide NASA Management with mass properties data, it is necessary that certain controls and documents be developed and maintained on a continuing basis throughout the design and launch phases. The NASA/MSC Mass Properties personnel are responsible for directing contractors efforts, receiving, monitoring and evaluating mass properties reporting, establishing weight budget allocations, approving design weight changes, resolving system interface weight problems and evaluating mission performance capability, effects on mass properties parameters and changes hereto.

The TRW Mass Properties support program as presented in this document will assure the fulfillment of NASA/MSC program objectives.

Table 2-3. Program Implementation

Mass Properties

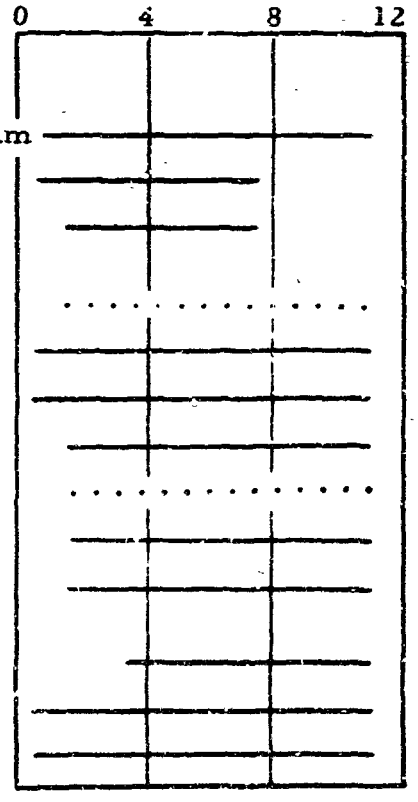
Period of performance
10 months in determing
level of MTS



Implementation

(Completed)

Sustaining



1. Manage TRW Mass Properties Program
2. Mass Properties Control Inputs
3. Mass Properties - GFE Control Inputs
4. Performance Analysis Reports
5. Prepare Tab Run
6. Prediction Analysis
7. Subsystem Evaluation
8. Subsystem Evaluation Reports
9. Data System Tradeoff Studies
10. Inputs to Critical Parameters Reports
11. Inputs to Final Action Report
12. Program Coordination
13. Informal Support

Table 2-4. Reports

Title	Originator	Periodicity	Due Date	Report Distribution					NASA Approval Required
				NASA-Tot.	ASPO	TRW	NAA	CAEC	
NASA REQUIRED									
Monthly Mass Properties Status Report	Contractors	Monthly	10th of Each Month	50	50	(1) From Each Cont.	---	---	NASA Acceptance Required
Actual Measurement Report	Contractors	As Required	30 Days After Measurement	25	25	---	---	---	NASA Acceptance Required
Predicted Preflight Report	Contractors	NA	90 Days Prior to Launch	25	25	---	---	---	NASA Acceptance Required
Final Preflight Report	Contractors	NA	15 Days Prior to Launch	25	25	---	---	---	NASA Acceptance Required
Pre-Launch Data	Contractors	NA	Immediately Prior to Each Launch	As Required	As Required	---	---	---	NASA Acceptance Required
Critical Design Study Data	Contractors	Annually or As Required	Sept.	NA	NA	---	---	---	NASA Acceptance Required
Computer Cards or Tape	Contractors	Monthly	10th of Each Month	1	1	(1) From Each Cont.	---	---	No
Actual Weight Summary	Contractors	As Required	10 Days After Act. Measurement	(2) + (1) Repro.	(2) + (1) Repro.	---	---	---	NASA Acceptance Required
Mass Distribution and Advanced Powered Flight Mass Properties		As Required	10 Days After Act. Measurement	(2) + (1) Repro.	(2) + (1) Repro.	---	---	---	NASA Acceptance Required
Control Log Data	Contractors	As Required	30 Days After Measurement	25	25	---	---	---	NASA Acceptance Required
Weight and Balance History Log Summary	Contractors	Weekly	(1) Week After Measurement	(2) + (1) Repro.	(2) + (1) Repro.	---	---	---	NASA Acceptance Required

Table 2-4. Reports (Continued)

Title	Originator	Periodicity	Due Date	Report Distribution					NASA Approval Required
				NASA-Hq.	ASPO	TRW	NAA	GAEC	
TRW REQUIRED									
Mass Properties Detail Report & Pred. Analy.	TRW	Monthly	*	---	---	As Required	---	---	No
Mass Properties Status Report	TRW	Monthly	*	---	---	As Required	---	---	No
Service Report (Tab Run)	TRW	Monthly	**	3	3	2	---	---	NASA Acceptance Required
Critical Parameter Report Inputs	TRW	Monthly	*	---	---	As Required	---	---	No
Final Action Report Inputs	TRW	Monthly	*	---	---	As Required	---	---	No

*15 Days After Receipt of Contractors Inputs
**10 Days After Receipt of Contractors Inputs